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Research Article

Notes on Liocranidae (Arachnida, Araneae, Dionycha) from Georgia with description of a new species

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Abstract

The faunistic status of the spider family Liocranidae in Georgia is revised. Due to the preoccupation of the liocraniid genus *Sagana* Thorell, 1875, by a saturniid moth genus *Sagana* Walker, 1855 (currently placed in *Copaxa* Walker, 1855), the genus *Drapeta* Menge, 1875, is resurrected, hence the transfer of its type species *D. rutilans* (Thorell, 1875), **comb. nov.** and *D. concolor* (Simon, 1878), **comb. nov.** A new species, namely *Drapeta caucasica* **sp. nov.**, is described from Georgia based on the male and female specimens from the Adjara region and Tbilisi vicinity. This is the third species of this previously considered monotypic genus. DNA barcoding results, diagnostic drawings, and detailed collecting data on *Drapeta caucasica* **sp. nov.**, with a list of the Georgian Liocranidae, and previous records of ex-*Sagana rutilans* Thorell, 1875, in the Caucasus are discussed.

Key words: biodiversity, Caucasus, *Drapeta*, faunistic, morphology, new combination, spiders

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Introduction

The family Liocranidae Simon, 1897, presents a compelling subject for arachnologists, characterized by its taxonomic intricacies and ecological adaptations. Comprising 247 species distributed across 36 genera globally (WSC 2024), this family of small to medium-sized spiders epitomizes the rich diversity inherent in araneofauna. However, due to the lack of pronounced synapomorphies, the precise delineation of the family remains a subject of ongoing taxonomic debate, with subfamily classifications demonstrating significant controversy among scholars (Deeleman-Reinhold 2001; Bosselaers and Jocqué 2013; Ramírez 2014). Recent taxonomic assessments have yielded disparate subfamily designations, reflecting the complex nature of Liocranidae systematic arrangement. While Bosselaers and Jocqué (2013) recognize two subfamilies (Cybaeodinae Simon, 1893, and Liocraninae Simon, 1897), Ramírez (2014) presents a contrasting perspective by proposing a single subfamily (Oedignathinae Simon, 1897) without further subdivision. At last, Marusik et al. (2008) described a

new subfamily Paratinae based on the shape of the copulatory organs and somatic characters of *Paratus* spp. This taxonomic discordance underscores the ongoing challenges associated with accurately defining the familial boundaries of Liocranidae. A recent study of spider diversity in Central Asia has revealed intriguing features within the Liocranidae, unknown in all other spiders (Marusik and Fomichev 2020).

Beyond its taxonomic intricacies, the ecological versatility of Liocranidae merits attention. As terrestrial hunters, these spiny-legged sac spiders inhabit diverse ecosystems ranging from forests to arid habitats, underscoring their adaptability and ecological resilience (Gündüz and Allahverdi 2018; Dippenaar-Schoeman et al. 2021; Lu et al. 2023).

The history of the family Liocranidae studies in the Caucasus is relatively poor, as until the beginning of the 21st century, *Sagana rutilans* Thorell, 1875 (Spassky 1937 as *Liocranum rutilans* Thor.), recorded from the Black Sea coast of Georgia (Batumi, Poti, Makhinjauri, Gumista Reserve) and Russia (Khosta) (Otto 2022), remained the only species. By the present time, the local diversity of liocranids, grouped in two subfamilies Cybaeodinae Simon, 1893 and Liocraninae Simon, 1897, includes nine species classified in six genera, most richly represented in Georgia, largely due to collecting efforts carried out within the framework of the Caucasus Barcode of Life (CaBOL) project (Nentwig et al. 2024; Otto 2022; Seropian et al. 2023b, 2024). This study expands our understanding of Liocranidae diversity in Georgia by reporting the first records of *Apostenus* cf. *humilis* Simon, 1932, and *Liocranoeca spasskyi* Ponomarev, 2007. While working on the present manuscript, we discovered that Thorell (1875) mistakenly placed *Drapeta aeneus* Menge, 1875, in what he believed was the newly established genus *Sagana* (Bertkau (1880) suppoted the synonymy), which was preoccupied by a genus of Lepidoptera (Walker, 1855), currently synonymized with a moth of the genus *Copaxa* Walker, 1855 (Michener 1952; Wolfe 2005). Therefore, to avoid homonymy, we resurrect the genus *Drapeta* sensu Menge (1875), hence the transfer of its type species *D. rutilans* (Thorell, 1875), **comb. nov.** and *D. concolor* (Simon, 1878), **comb. nov.** , recently assigned to the genus *Sagana* (Bosselaers 2024). Additionally, a new species, *Drapeta caucasica* **sp. nov.**, is described. The identification of this species was first revealed based on the COI barcoding, highlighting its effectiveness in detecting cryptic taxa and prompting a more detailed morphological examination of a single female from the vicinity of the Kveda Agara Village (Adjara), originally identified as *D. rutilans*.

Materials and methods

Sampling

The material was collected in different parts of Georgia (including both protected and unprotected areas) within the framework of the Caucasus Barcode of Life (CaBOL) project (https://ggbc.eu/). Samples were collected by hand and aspirators. Sampling details are given below. The elevations and GPS coordinates (given in WGS84) were obtained via Garmin GPS MAP 64s.

Collected specimens were preserved in 96% ethanol and stored in a freezer at -22 ˚C at the scientific collections of Ilia State University (Georgia, Tbilisi) and the Leibniz Institute for the Analysis of Biodiversity Change (former ZFMK)

(Germany). Unique ID numbers of the preserved material (CaBOL-ID, ZFMK-TIS) indicate the depositories (Ilia State University and the Leibniz Institute for the Analysis of Biodiversity Change, respectively). Identification was done by the authors using literature sources on Caucasian spiders (see list in Otto 2022) as well as Nentwig et al. (2024) and sources listed therein. We used a Zeiss Stemi 508 Stereo Microscope with 8:1 Zoom and a Zeiss Apo 1.5x FWD 53 mm front lens for measurements and specimen identification. Drawings were made by the corresponding author based on microscope photographs using a Wacom CTH-690 Intuos Medium Pen and Touch Tablet with the programs Krita (version 2.9.7) and Photoshop CS6 (version 13.0). Drawings show the left male palpus, the female epigyne, and the endogyne; perspective and scale bars are given in the plates and their captions (KOH). The female epigyne and endogyne were prepared using a 30% solution of potassium Hydroxide. Leg spination is illustrated in a schematic representation (Figs 8–10) where prolateral, dorsal, retrolateral, and ventral sides of leg articles are flattened as a folding net (Dürer 1525). Genitalia terminology according to Deeleman-Reinhold (2001).

DNA processing

DNA extraction at LIB Museum Koenig Bonn followed the standard protocols of the GBOL (German Barcode of Life) project (Geiger et al. 2016; http://www.bolgermany.de). DNA extraction at ISU followed the customized protocol (Seropian et al. 2023a, b). Extracted DNA and remnants of the specimens were deposited at the LIB Museum Koenig Bonn and scientific collections of Ilia State University, Tbilisi, Georgia, while the sequences were submitted to Barcode of Life Data Systems (BOLD) databases. The newly obtained DNA barcodes of COI sequences were checked against the BOLD Systems database (http://www.boldsystems.org/index.php). Barcode Index Number (BIN) (Ratnasingham and Hebert 2013) for the sequenced taxa and their nearest neighbor in BOLD Systems (if they had a BIN) are also given. For the calculation of sequence differentiation, we used p-distance as performed in the BOLD Systems.

Abbreviations

ALE – anterior lateral eyes;
AME – anterior median eyes;
PLE – posterior lateral eyes;
PME – posterior median eyes;
rl – retrolateral;
do – dorsal;
Et – embolus tip;
Fe – femur;
Mt – metatarsus;
Pa – patella;
pl – prolateral;
Ta – tarsus;
Ti – tibia;
ve – ventral;
RTA – retrolateral tibial apophysis;
Rt – retrolateral tegular apophysis;
BCE – basal cymbial extension;
AP – anterior pocket;
BuC – bursa copulatrix;
CD – copulatory duct;
plv – prolateral ventral;
rlv – retrolateral ventral;
CO – copulatory opening;
EP – epigynal plate;
F – fovea;
St – spermatheca;
Ss – sickle-shaped sclerite;
NP – National Park;
Mun. – municipality;
Vill. – village.

Results

In total, 20 specimens of Liocranidae were collected in Georgia by Stefan Otto and within the CaBOL project by the authors (Seropian et al. 2023b, 2024, present study). As a result of these collecting efforts, the number of local liocranid species increased from two to eight, including the herein described new species. The list below is given in alphabetical order.

Family Liocranidae Simon, 1897
Subfamily Cybaeodinae Simon, 1893
Genus *Agroeca* Westring, 1861

Agroeca brunnea Blackwall, 1833

Agroeca brunnea: Seropian et al. 2023b: 258, figs 64–65 (♂).

Distribution. Europe, Turkey, Georgia, Russia (Europe to Far East), China, Japan (WSC 2024).

Records in Georgia. Gori (Shida Kartli region) (Seropian et al. 2023b).

Agroeca cuprea Menge, 1873

Agroeca cuprea: Ponomarev and Komarov 2015: 130.
Agroeca cuprea: Seropian et al. 2023b: 258.

Distribution. Mediterranean region, Europe, Caucasus, Russia (Europe to South Siberia), Iran, Central Asia (WSC 2024).

Records in Georgia. Atsriskhevi Vill., Tskhinvali (Samachablo region) (Ponomarev and Komarov 2015), Gori (Shida Kartli region), Tbilisi, Didgori Vill. (Tbilisi), Batsara Nature Reserve (Kakheti region) (Seropian et al. 2023b).

Agroeca lusatica (L. Koch, 1875)

Agroeca lusatica: Seropian et al. 2023b: 259, supplementary file (♀).

Distribution. Europe, Georgia, Russia (Europe, Caucasus, South Siberia), Kazakhstan, Iran (WSC 2024).
Records in Georgia. S of Aiazmi Vill., Bozali Vill. (Samtskhe-Javakheti region) (Seropian et al. 2023b).

Agroeca maculata L. Koch, 1879

Agroeca maculata: Seropian et al. 2024: 101, figs 20–21 (♀).

Distribution. Ukraine, Georgia, Russia (Caucasus, Europe to Far East), Kazakhstan (WSC 2024, Otto 2022).

Records in Georgia. North of Shevardeni (Mtskheta-Mtianeti region) (Seropian et al. 2024).

Genus *Apostenus* Westring, 1851

Apostenus cf. *humilis* Simon, 1932

Apostenus cf. *humilis*: Seropian et al. 2024: 102, fig. 22 (♀).

Distribution. Portugal, Spain, France (WSC 2024).

Records in Georgia. Gori, Kvernaki ridge (Shida Kartli region) (Seropian et al. 2024).

Subfamily Liocraninae Simon, 1897
Genus *Mesiotelus* Simon, 1897

Mesiotelus caucasicus Zamani & Marusik, 2021

Mesiotelus caucasicus Seropian et al. 2023b: 259, fig. 66 (♀).

Distribution. Armenia, Azerbaijan, Georgia, Iran, Turkey (WSC 2024).

Records in Georgia. Vardzia (Samtskhe-Javakheti region) (Seropian et al. 2023b).

Genus *Drapeta* Menge, 1875 (status revalidated)

Type species. *Sagana rutilans* Thorell, 1875

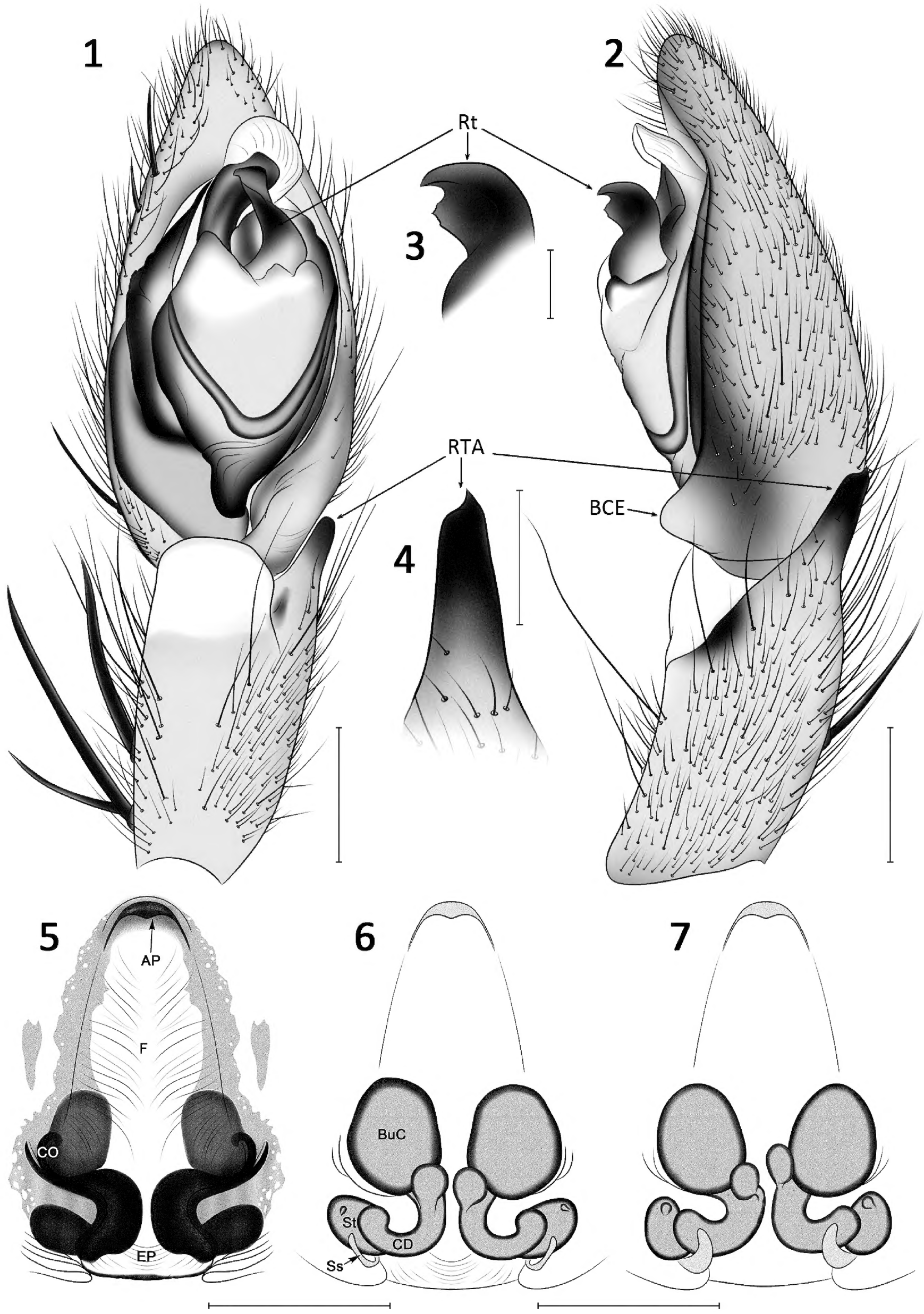
Drapeta caucasica sp. nov.

https://zoobank.org/82D4EA25-DACE-4C6A-9EC6-EB3DDDBE2F26
Figs 1–11

Type material. Holotype. ♂ (CaBOL-ID 1038195); Georgia, Tbilisi, Telovani Vill.; N41.8025°, E44.6775°; 888 m a.s.l.; deciduous forest, roof tiles pile; 10 Oct. 2023; leg. A. Seropian and N. Bulbulashvili. Paratypes. ♀ (CaBOL-ID 1035523); same location; 27 May 2023; leg. A. Seropian and N. Bulbulashvili. 2 ♀♀ (CaBOL-IDs 1009165, 1009166); same location; 27 Apr. 2024; leg. A. Seropian and N. Bulbulashvili. 1juv. (CaBOL-ID 1023290); same location; 02 Feb. 2022; leg. N. Bulbulashvili. ♀ (ZFMK-TIS 8008466); Adjara, Keda Mun., NE of Kveda Agara Vill.; N41.6020°, E41.9020°; 19 July 2019; leg. H-J. Krammer.

Diagnosis. The male of the new species differs from those of *D. rutilans* (Thorell, 1875), by the combination of the following characteristics best viewed in retrolateral (Figs 1–4): bifurcated retrolateral tegular apophysis (vs. claw-shaped) (Grimm 1986: fig. 43a), RTA with pointy end (vs. oblique) (Grimm 1986: fig. 43b), and more protruding BCE (vs. less prominent) (Grimm 1986: fig. 43a). Females of *D. caucasica* **sp. nov.** can be generally separated from those of *D. rutilans* and *D. concolor* (Simon, 1878) by more closely positioned copulatory ducts and overall darker epigyne (Figs 5–7).

Description. Male (holotype, CaBOL-ID 1038195). Total length 7.1. Carapace 3.15 long, 2.75 wide. Chelicera brown, with 2 prolateral and 3 retrolateral teeth. Eye diameters and interdistances: AME 0.14, ALE 0.16, PME 0.14, PLE 0.16.



Figures 1–7. *Drapeta caucasica* **sp. nov.** (**1**: holotype male, left palp, ventral view; **2**: ditto, retrolateral view; **3**: retrolateral tibial apophysis, dorsal view; **4**: lateral tegular apohysis, retolateral view; **5**: paratype female, CaBOL-ID 1035523 epigyne, ventral view; **6**: endogyne, dorsal view; **7**: paratype female, ZFMK-TIS 8008466l, endogyne, dorsal view). Scale bars: 0.5 mm (1–2, 5–7); 0.2 mm (4); 0.1 (3).

Color and pattern as shown in Fig. 5. Sternum smooth, light-yellow, with darker margins; labium and maxillae light-yellow, with dense black setae apically. Spinnerets light-yellow. Leg measurements in Table 1; spination as in Figs 8–10; Ta with pectinate claws, claw tufts, and tenent hairs. Palp as in Figs 1–4: tegular apophysis bifurcated; RTA long, darkened apically, with pointy end; cymbium with strong basal extension (BCE).

Female (paratype, CaBOL-ID 1035523). Coloration as in male. Total length 9.2. Carapace 3.32 long, 2.9 wide. Sternum smooth, light brown with maroon margin, 1.94 long, 1.42 wide. Eye diameters: AME 0.15, ALE 0.25, PME 0.21, PLE 0.14, PME-PME 0.24, PME-PLE 0.16. Chelicerae as in male. Leg measurements as in Table 1. Epigyne as in Fig. 5, about 2 times longer than wide; epigynal plate semitransparent, triangular, with deeply cut lateral margins diverging posteriorly, forming an approximate angle of 40º (vs. shallow cut and less diverged in *D. rutilans* and *D. concolor*); AP wide, approximately 2.8 smaller than the foveal margin's maximal span, with a medially protruding anterior margin (vs concave in *D. rutilans* and *D. concolor*). Endogyne as in Figs 6–7; ST oval, anteriorly with small glandular structures; CD curved and closely positioned to each other, giving the epigynal plate an overall darker ventral appearance compared to that of *D. rutilans* and *D. concolor*, anteriorly with large oval glandular structures; BuC large and oval shaped.

Etymology. The specific epithet is an adjective referring to the type locality of the new species.

Habitat. Deciduous forest.

Distribution. Known only from the above-listed localities in Georgia.

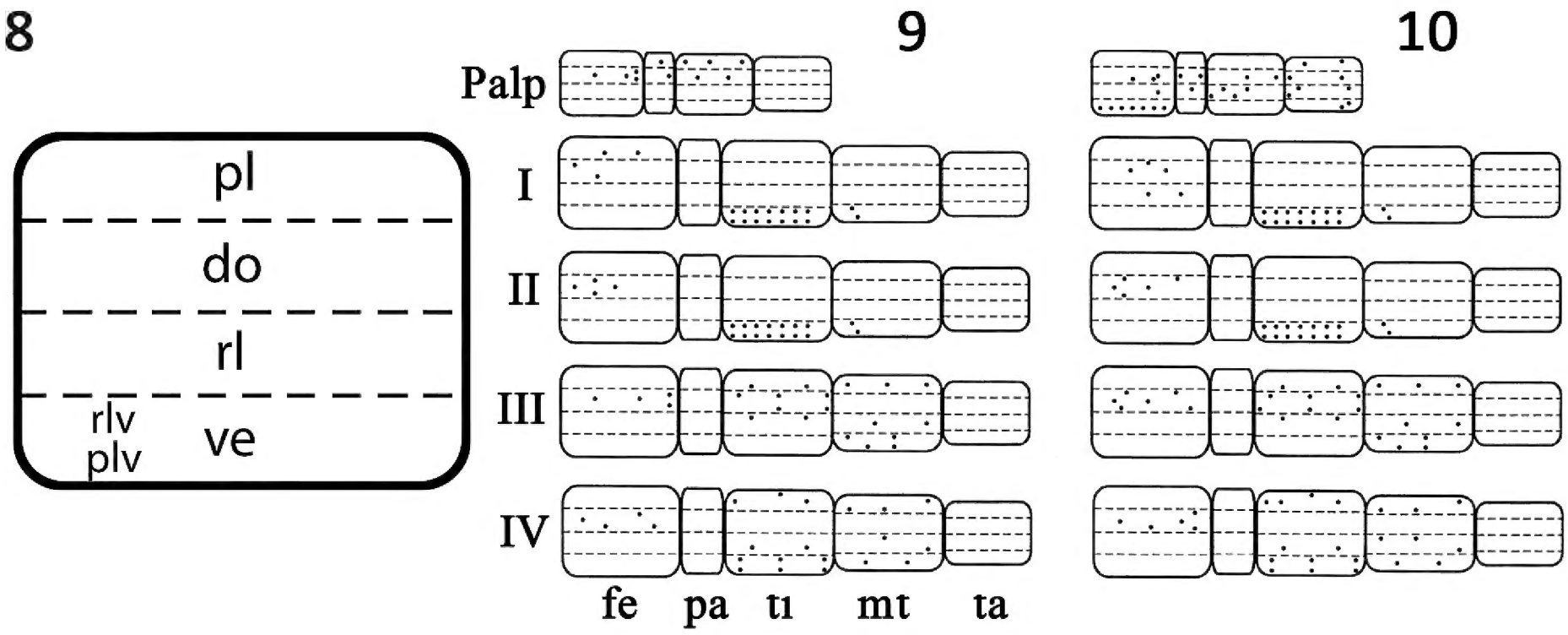
Barcoding results. Two nearly identical COI subunit barcodes were obtained from the specimens CaBOL-ID 1023290 and ZFMK-TIS 8008466 (BOLD:AFP6894, *p*-distance 0.46%) with the nearest neighbor in the BOLD Systems *Sagana rutilans* from Greece with an Early-Release status (mean *p*-distance 8.36%).

Remarks. Spassky (1937) recorded *D. rutilans* (as *S. rutilans*) from the Black Sea coast of Georgia and Russia; however, he did not provide any diagnostic illustrations or other data regarding the quantity or gender of the studied material. Mcheidze (1997) and Kovblyuk et al. (2011) present new data on the distribution of this species in Georgia based on the collected females, again without providing diagnostic illustrations. Considering the strong resemblance of the females' habitus, copulatory organs, and the status of the genus *Drapeta*, which has long been considered monotypic, previous records of *D. rutilans* from the Caucasus most probably refer to the herein described species *D. caucasica* **sp. nov.**

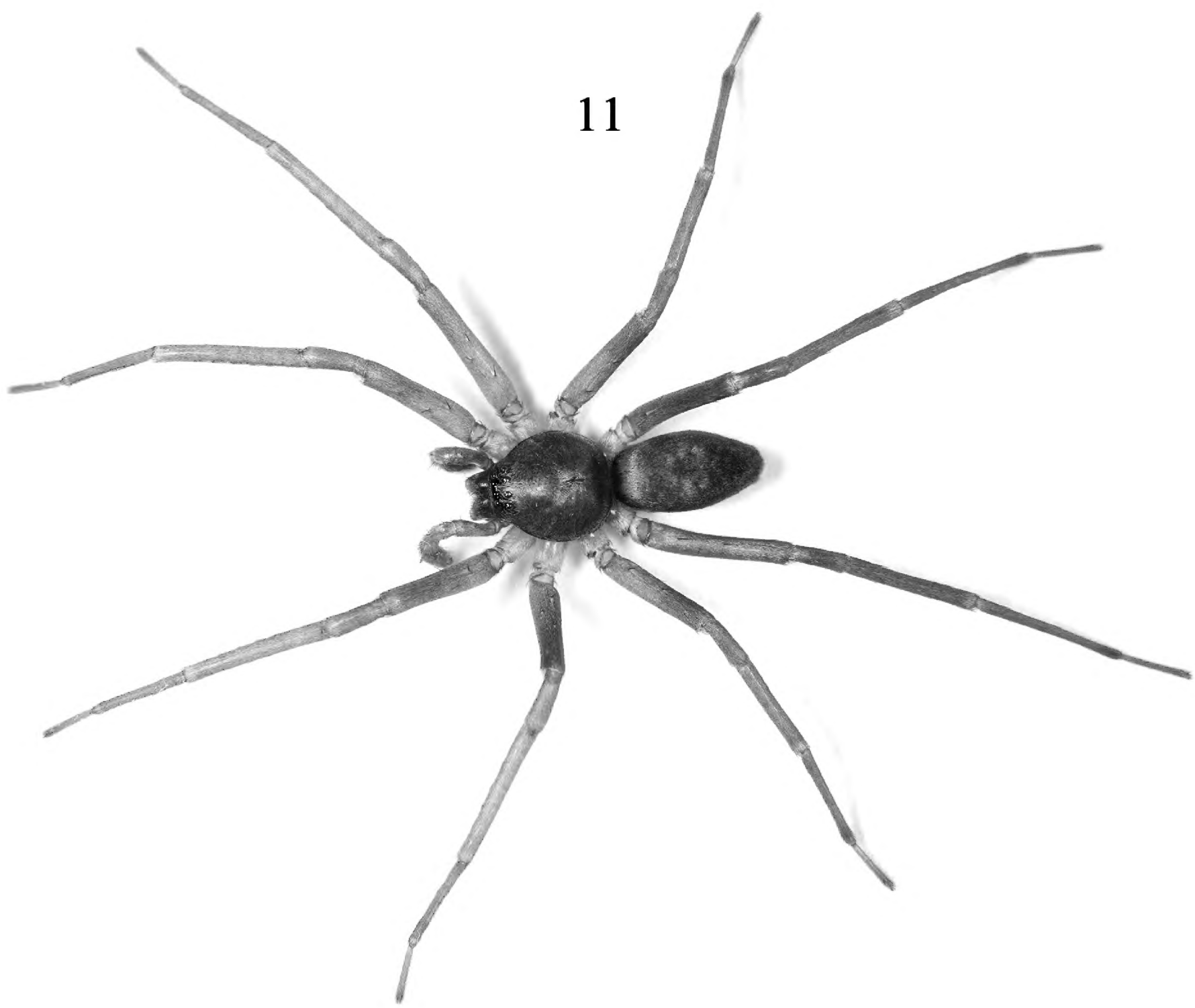
Additional notes. Specimens with unique CaBOL-IDs 1038195, 1009165, and 1009166 were caught as juveniles and home-reared.

Discussion

Based on our results, there are currently eight species of Liocranidae known from Georgia and nine from the Caucasus region. However, given the ongoing nature of arachnological research in the area, the actual diversity of Liocranidae in the region is likely to increase as new species are discovered and documented (Zamani and Marusik 2021; Zarikian and Kalashian 2021; Seropian



Figures 8–10. Leg spination schematics (**8**: legend; **9**: *Drapeta caucasica* **sp. nov.**, male, holotype; **10**: *D. caucasica* **sp. nov.**, female, paratype).



Figures 11. *Drapeta caucasica* **sp. nov.**, habitus of live holotype male.

Table 1. Length of leg measurements. Male/female (holotype/paratype).

	Fe	Pa	Ti	Mt	Ta	Total
I	3.3/3.04	1.55/1.39	3.75/3.28	2.64/2.42	1.18/1.24	12.42/11.4
II	3.15/3.15	1.34/1.3	3.96/3.1	2.98/2.41	1.49/1.19	12.92/11.12
III	3.12/2.89	1.05/1.39	2.73/2.42	4.85/2.37	1.35/1.11	11.13/10.15
IV	3.46/2.42	1.19/1.46	3.43/3.44	3.87/3.73	1.41/1.34	13.36/12.33

et al. 2023b, 2024; present study). Further DNA barcoding and new sampling efforts, especially in remote and historically poorly studied areas, could yield more new species, while morphological re-examining and barcoding of the previously recorded *D. rutilans* specimens from the Caucasus is needed for species validation.

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Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

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Author contributions

Conceptualization: All authors have contributed equally.

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Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.

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